

II. REMARKS

Applicants gratefully acknowledge the Examiner's determination that claims 2, 4, 7-10 and 12-15 contain allowable subject matter (Office Action, dated November 13, 2006, at 4, line 11, to at 5, line 2).

The Examiner has objected to the drawings on the grounds that reference character "16," shown in Figure 1, is not mentioned in the specification (Office Action, dated November 13, 2006, at 2, lines 4-6). However, the Examiner is mistaken. Applicants' specification, as originally filed, describes at 10, lines 6-9, that the character reference "16" designates an "electronic control unit." Therefore, Applicants traverse the Examiner's objection to the drawings.

Claim 2 has been canceled without prejudice. Claims 1, 7, 8, 10 and 12-15 have been amended, and new claims 16 and 17 have been added. Specifically, claim 1 has been amended to additionally recite "wherein the displacement of the piston is formed by superimposing a portion with constant speed in an opposite direction to a displacement direction during an injection as well as a discontinuous portion during an injection process" as supported on page 10, lines 10-12, of Applicants' specification as originally filed.

Claims 7, 8, 10 and 12-15 have been amended to depend upon new independent claim 16. The present amendment has no further limiting effect on the scope of claims 7, 8, 10 and 12-15.

New claim 16 corresponds to previous claim 2 rewritten in independent form. Therefore, new claim 16 has the same scope as previous claim 2. New claim 17 corresponds to previous claim 4 rewritten in independent form. Therefore, new claim 17 has the same scope as previous claim 4.

A. The Invention

The present invention pertains to a device for measuring time-resolved volumetric flow processes of injection processes in internal combustion engines. In accordance with one embodiment of the present invention, a device for measuring time-resolved volumetric flow processes of injection processes in internal combustion engines is provided that includes the features recited by independent claim 1. In accordance with another embodiment of the present invention, another device is provided that includes the features recited by independent claim 16. In accordance with yet another embodiment of the present invention, another device is provided that includes the features recited by independent claim 17. Various other embodiments, in accordance with the present invention, are recited in the dependent claims.

An advantage of the various embodiments of the present invention is that a device for measuring time-resolved volumetric flow processes of injection process in internal combustion engines is provided that is capable of measuring the more complicated fuel injection processes of modern internal combustion engines.

B. The Rejection

Claims 1, 3, 5, 6 and 11 stand rejected under 35 U.S.C. § 102(e) as anticipated by Unger et al. (U.S. Patent 7,000,450, hereafter the “Unger Patent”).

Applicants respectfully traverse the Examiner’s rejection and request reconsideration of the above-captioned application for the following reasons.

C. Applicants’ Arguments

Independent claims 16 and 17 are allowable for the reasons of record. Claims 7, 8, 10 and 12-15 depend either directly or indirectly on independent claim 16, and are likewise allowable.

i. The Section 102(e) Rejection

Anticipation under 35 U.S.C. § 102 requires showing the presence in a single prior art reference disclosure of each and every element of the claimed invention, arranged as in the claim. Lindemann Maschinenfabrik GMBH v. American Hoist & Derrick, 221 U.S.P.Q. 481, 485 (Fed. Cir. 1984). In this case, the Examiner has failed to establish a prima facie case of anticipation against Applicants' claims because the Unger Patent does not teach, or suggest, each and every element of the claimed invention.

ii. The Unger Patent

The Unger Patent discloses a “method, computer program and device for measuring the injection quantity of injection nozzles, especially for motor vehicles,” wherein an injection system (32) injects a testing fluid into a measuring chamber (45) and a detection device (68) detects a movement of a piston (40), which at least partially defines the measuring chamber (See Abstract of the Unger Patent, and Figure 1). The detection device disclosed by Unger generates a corresponding measurement signal and in order to increase the precision of the calculation of the injected testing fluid mass, the Unger Patent discloses that the pressure of the testing fluid in the measuring chamber is detected and that the measurement signal is processed by taking into account the detected pressure (See Abstract).

However, the Unger Patent does not teach, or suggest, that “the displacement of the piston is formed by superimposing a portion with constant speed in an opposite direction to a displacement direction during an injection as well as a discontinuous portion during an injection process” as recited by independent claim 1. Thus, in accordance with the present invention, it is possible to carry out continuous measurement due to the importance of the continuous displacement of the piston while change in pressure that is oscillating is avoided

by compensating for it. Consequently, the change in pressure in the measurement chamber can be accounted for even when the change in pressure occurs due to the actual injection process itself (i.e., due to the pressure of the injection jet). On the other hand, the Unger Patent discloses that mere integral changes in pressure are measured in the measurement chamber, which occurs due to different volume amounts in the measurement chamber and is additionally affected by increases in the density of the injected mass of testing fluid (col. 5, lines 29-42).

This is not the only deficiency in the disclosure of the Unger Patent. The Unger Patent also does not teach, or suggest, a “device for measuring time-resolved volumetric flow processes,” as recited by claim 1, because the piston (40) is supported from below by helical spring (42) so that oscillations in the system will be unavoidable (See Figure 1). Furthermore, the Unger Patent discloses that it is necessary to periodically empty measuring chamber (45) of testing fluid via magnetic drain valve (53), (col. 4, lines 29-28). From these facts, a person of ordinary skill in the art would realize that the device disclosed by the Unger Patent is not capable of continuous measurement and is likewise not capable of time-resolution of an individual injection. Consequently, the measurement results for the device disclosed by Unger cannot be evaluated qualitatively. In addition, a person of ordinary skill in the art would realize that it is not possible to dispose the device disclosed by Unger in front of the injection valve in order to continuously measure injection amounts and injection curves in a running motor.

For all of the above reasons, the Examiner has failed to establish a prima facie case of anticipation against the claims of the above-captioned application.

III. CONCLUSION

Claims 7, 8, 10 and 12-17 are allowable for the reasons of record. Furthermore, the Examiner has failed to establish a prima facie case of anticipation under 35 U.S.C. § 102(e) because the Unger Patent does not teach, or suggest, that “the displacement of the piston is formed by superimposing a portion with constant speed in an opposite direction to a displacement direction during an injection as well as a discontinuous portion during an injection process” as recited by independent claim 1. Thus, claims 3-6 and 11, which depend either directly or indirectly on claim 1, are likewise allowable.

For all of the above reasons, claims 1 and 3-17 are in condition for allowance, and a prompt notice of allowance is earnestly solicited.

Questions are welcomed by the below-signed attorney for applicants.

Respectfully submitted,

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